sustainability

MDPI

Article

Knowledge Network for Sustainable Local Development

Freddy Marín-González [1,*], Alexa Senior-Naveda [1], Mercy Narváez Castro [2], Alicia Inciarte González [1] and Ana Judith Paredes Chacín [3]

[1] Department of Humanities, Universidad de la Costa, Barranquilla 080005, Colombia; asenior@cuc.edu.co (A.S.-N.); ainciart1@cuc.edu.co (A.I.G.)
[2] Department of Management, Universidad del Zulia, Punto Fijo 4011, Venezuela; mercynarvaez@gmail.com
[3] Department of Administration and Finance, Universidad Autónoma de Occidente, Cali 760030, Colombia; ajparedes@uao.edu.co
* Correspondence: fmarin1@cuc.edu.co

Abstract: This article aims to build a network for the exchange of knowledge between the government and production, community and university sectors for sustainable local development. To achieve this, the authors relied on the concepts of sustainable local development, social capital, the relationship between sectors or intersectorality, networks and interdisciplinary and transdisciplinary knowledge. Regarding the methodology, the abductive method was used. Under a documentary design, the research techniques were a content analysis of theoretical documents and the deductive inference technique. The construction of a knowledge exchange network for sustainable local development stands out as the result. It is concluded that knowledge networks for sustainable local development have positive implications in the establishment of alliances and links between the sectors that make up society.

Keywords: sustainable local development social capital; knowledge networks; intersectorality

Citation: Marín-González, F.; Senior-Naveda, A.; Castro, M.N.; González, A.I.; Chacín, A.J.P. Knowledge Network for Sustainable Local Development. *Sustainability* **2021**, *13*, 1124. https://doi.org/10.3390/su13031124

Academic Editor: David Gibbs
Received: 4 November 2020
Accepted: 8 January 2021
Published: 21 January 2021

1. Introduction

Sustainable local development refers to a set of transformations that can be carried out in a territory once the economic, social and environmental dimensions have been balanced. It can also be considered a product at the end of the process that produces it. Sustainable development positively impacts a certain territory and the sum of these changes or actions accumulates, extends and generates well-being in people and organizations; at the same time, it generates balanced relationships in the economic, environmental and social spheres [1–4].

For these changes to be balanced, people and organizations must build and apply the social knowledge generated as a result of the implementation of environmental, economic and social investment policies, strategies and decisions in the sectors of their activities and organizations that support life in local territories, in addition to connecting with each other based on common objectives and the exchange of various resources [5].

In consideration of the previous approaches, it may be noted that intersectoral cooperation has been scientifically studied since the 20th century. One of the antecedents is the World Summit on Sustainable Development, held in Rio de Janeiro in 1992 [6]. At this summit, the Sustainable Development objectives emerged (which have served as a guide for the objectives of subsequent summits); one of them raised the urgency of joint action between all sectors and spheres of human activity, which is necessary to achieve sustainability goals such as social equity, environmental health and wealth [7,8].

It was also stated at the Rio de Janeiro Summit that many problems in society remain unresolved because the separate actions of each sector hinder the achievement of Sustainable Development goals; in contrast, joint actions could help to find solutions to the main obstacles [9]. According to [10], the science of sustainability was consolidated as an international science policy project in the preparations for the World Summit on

Sustainable Development held in Johannesburg in 2002. The concept articulates a new vision of science and a transition towards sustainability, and is, therefore, an attempt to strengthen the dialogue between science and society [11].

In light of these comments, this article was composed with the aim of building a network for the exchange of knowledge between the government and production, community and university sectors, for sustainable local development. The work is structured as follows: first, the background to the study is presented; then, an analytical theoretical system is proposed; next, the research methods, results and a discussion are presented; finally, conclusions are drawn.

2. Background of the Study

Intersectorality promotes the improvement of the standard of living of localities and rural or urban territories based on cooperation between the sectors that comprise it. In this relationship, knowledge is produced as an expression of social processes and production activities according to their nature; in the present study, this knowledge is called the stock of endogenous capacities, which promotes sustainable productive economic development [12–14].

An example of the previous statements about endogenous capacities and the construction of knowledge can be found in the research carried out by [15], which examined how knowledge-action systems are generated as a product work in localities where relations between sectors take place, as well as the networks of actors involved in the production, exchange and use of knowledge to apply development policies and achieve sustainable results. The research started from the assumption that very little is known about how knowledge-action systems work in localities, and how they should be designed to address their complexity. To respond to this knowledge gap, the relationships and networks of actors and the knowledge used and generated through the use of land and the governance of green areas in San Juan, Puerto Rico—where there is a political conflict around the issue of employment—were examined.

Interdisciplinary methodological techniques were used which were part of the Knowledge and Action System Analysis Framework (KASA), which integrates concepts of social network analysis and knowledge coproduction (this framework has interdisciplinary, epistemological, cultural and conceptual components). The analysis revealed the formation of a diverse network of actors that contribute with different types of knowledge, thus showing potential for sustainability, creativity and innovation. Cultural and epistemological divergences were also evidenced, and it was observed that knowledge-produced actions related to professionals and disciplinary knowledge, as in the case of agriculture, architecture and planning, are privileged over others, which reflects competing knowledge systems in land use and planning of green areas in San Juan [15].

Relatedly, an investigation was carried out in Mexico [16] in which an experience was studied in terms of collaboration strategies and the challenges presented by multiple stakeholders. This research addressed the challenges and strategies in spaces of collaboration of representatives of different sectors that sustain life in a given locality, with the purpose of addressing the factors that hinder their work in the Global South.

For this, a total of 128 participants in 38 projects throughout Mexico attended collaborative workshops. Most of the participants belonged to local communities (29%), academic institutions (25%) or CSOs (24%). Government stakeholders represented 14%, comprising representatives from local governments, protected area managers, national government personnel and research institution employees. A small percentage of participants belonged to companies (8%), all of which were Social Enterprises [16].

The results grouped the factors that impede the collaboration of multistakeholders into five categories; the most relevant was represented by factors associated with divergent visions and interests between sectors and stakeholders. It was also highlighted that divergent objectives, interests and priorities caused tensions, imbalance, weak participation of

MSCs and distrust among collaborators. Participants also noted tensions within sectors, mainly academia and government.

Based on this integrating vision, action initiatives for sustainable local development refer to the relationships of organizations, industries, commerce, society and educational and scientific institutions, which represent different sectors, the relationships among which allow the sharing of resources, and promote positive changes and transformations in the territories [8]. In this research, intersectorality is defined as the link between sectors [7].

An example of the relationships between sectors and the boost that these can give to sustainable local development is observed in a study carried out in China in the northwest region; in this region, there are relationships between the following sectors: industrial chemical, metal products and electricity, gas and water. Thus, the production and supply sector benefits from the leverage of other industries. In the same way, the construction sector, by interacting with the aforementioned sectors, is capable of promoting national economic development [17]. From these examples, it is possible to infer that the concept of intersectorality deals with relationships between the different sectors, with the idea of exchanging resources, goods and services that satisfy the demands of Society [8,12,17].

According to [18], intersectoral links arise and develop as a consequence of the need to promote mutual interests in companies from different branches and sectors [8,14]. In this sense, an intersector relationship is presented regarding the agroecological sector, the industrial sector and the commercial sector in Russia. This antecedent proposed a methodology for the formation and development of intersectoral links. It made it possible to evaluate the development factors of the national economic sectors based on the inputs and outputs of each process, and to identify those responsible for the final result.

Regarding the analysis, the primary sector needs a stable sales channel, processing companies or industrial companies are interested in the maximum use of their capacity to generate products, and trading companies are interested in the uninterrupted supply of excellent quality, profitable and finished products. The basis of intersectoral links lies in the exchange of knowledge, the establishment of alliances, resources and knowledge, which give value to companies and ensure economic development based on the profitability of production. It may be concluded that it is impossible to form a sustainable economy at the expense of the development and efficiency of intersectoral links [18].

In this sense, there is a strong demand for knowledge in the different sectors involved in local development [10,14,19]. To offer scientific explanations for the concepts of knowledge, interdisciplinary/transdisciplinary, intersectorality, networks and social capital, it is taken into account that the construction of knowledge arises from the participatory relationships and production that are established in the approach to externalities and expectations, be they social, environmental or economic [9,10,16,20,21].

This conception of knowledge is not limited to academic and research institutions; it also occurs in spaces where relationships among sectors take place [22–25]. According to these ideas, science and the application of policies for Development in localities complement each other to the extent that scientific knowledge is used to improve living conditions. To strengthen this complementarity, it is necessary to articulate the relationships between scientists, governors or decision-makers and society as a whole, since these worlds influence each other to generate development processes [14].

The different disciplines can be well integrated from a common approach to a complex problem, i.e., the use of theories from different disciplines that expand the conceptual frameworks of reference, and the application of research methods or techniques that merit interdisciplinary approaches. This knowledge arises as a product of the participatory configuration in Development processes [5,14,20]. It can also happen that society participates in certain processes such as consultations for the approval of projects for the sustainability of a locality; in such cases, the knowledge generated in exchanges between academics, researchers, decision makers and businessmen, is considered transdisciplinary, given the different points of view and interests of the parties involved [20,26].

This generation of knowledge is the result of relationships between the various sectors, and encourages the formation of cooperation networks [27,28]. A network is defined as an abstract representation of the relationships that exist between people, organizations or sectors for sustainable local development that involves collective learning processes associated with social capital, which is defined as the set of norms, values, links and bridges that facilitate collective action for mutual benefit [29–32].

The networks that arise among the aforementioned sectors produce knowledge [3,33]. These knowledge networks are intended to be shared among communities, NGOs and the government sector, but are useful for all sectors or a large part of them. The way in which the sectors are related or the intersectoral networks operate strengthens the ties between them; this increase in social capital is beneficial for sustainable local development, by ameliorating the social fabric as well as knowledge about sustainable local development [34].

This antecedent focuses on the importance of knowledge management in the development process. The objective is to build a regional knowledge network for sustainable regional improvement. The method used in this study is based on two theoretical and experimental obstacles. The study also provides feasible results by proposing a model for knowledge-based cities. The model helps regional/urban planners in managing knowledge production, organizing regional knowledge institutions and developing cities using the advantages of the network. The results of this work support the creation of knowledge networks in similar cities.

According to this antecedent, the generation and application of knowledge as a result of social learning is facilitated; at the same time, sustainable development processes are made possible in a given territory. Like an abstract, heuristic representation, an intersectoral network of transdisciplinary knowledge is designed, based on the social capital of the territory.

3. Method of Investigation

The research was based on the abductive method; this refers to the invention of new ideas or assumptions to explain the behavior patterns of real phenomena. Thus, abductive reasoning is based on a set of theories and creative inferences that necessitate the integration and justification of ideas to develop new knowledge [35,36]. This inference derives from the idea that most of the great advances in science do not follow the pattern of pure deduction.

According to [13,35,37], the explanation of this approach must be a proposition that provides a plausible explanation of an observed phenomenon, based on ideas arising from conceptual-theoretical analyses, in order to elucidate the characteristics and properties of the phenomenon under study.

The characteristics and properties of the network for the exchange of knowledge for Local Development emerge from theoretical analyses, Intersectorality, social capital and interdisciplinarity as fundamental concepts of sustainable local development.

Explanations are needed about how knowledge is produced and how relationships between sectors are established through diagrammatic shaping, i.e., knowledge networks for sustainable local development [38,39]. The present research draws upon existing theories which belong to theoretical framework disciplines: administration, marketing, sociology, human ecology, among others. This use of concepts and theories from various disciplines fosters the interdisciplinarity and transdisciplinarity of knowledge about sustainable local development [13–15].

Study of reality in the form of examples or representative antecedents of the construction of knowledge for sustainable local development facilitates the understanding of the processes of intersectorality, social capital and interdisciplinarity [38]. This knowledge has an abstract theoretical character on the one hand, and an empirical one on the other [36]. A diagrammatic and conceptual construction is produced using social action systems, as a representation of knowledge exchange in the form of a network between scientists and social actors [39].

Likewise, a documentary design was followed for the theoretical analysis, as well as the explanation of the theories of development, networks, interdisciplinary and transdisciplinary knowledge and intersectorality. The content analysis techniques used to form the conceptual theoretical sections—involving deductive inferences and theoretical syntheses—also served to relate theories belonging to different disciplines.

4. Analytical Theoretical System

4.1. Knowledge for Local Development

Knowledge about sustainable development is based on the generational principle, which refers to the fact that it must be renewed and maintained over time, taking into account the limits imposed by the environmental context [40]. Thus, in 2016, the United Nations Development Program (UNDP) launched the strategy of sustainable development goals as a continuation of the Millennium Development Goals. Local development is understood as a process of improvement and economic, social and environmental growth of a given area based on the use of endogenous resources in order to improve the well-being and quality of life of its population. The most characteristic element of the concept is found in endogeneity, which is associated with the resources of the locality [41]. This paradigm of Development is based on public collective action and that of the private sector.

Reciprocal relationships are established between governments, the production sector, society and academia (see Figure 1).

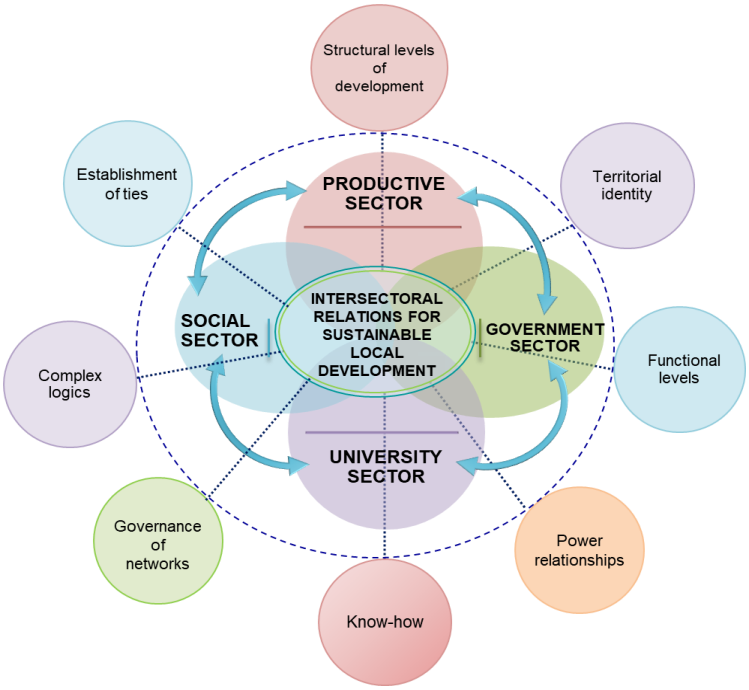

Figure 1. Own source. Intersectoral relations for Sustainable Local Development. The figure represents the characteristics and properties of the production, government, community and university sectors that are related to each other in the context of local development.

Knowledge regarding sustainable local development is generated from the exchange of goods and services among the production, governmental, social and university sectors. The relationships among these sectors favor local economic growth, taking into account the demand of services and supply of products to/from each sector [14].

These relationships among the sectors establish links with different characteristics (associated with the provision of services and exchange of products specific to each region); some links are strong and lasting (depending on long-lasting or casual relationships, and interests shared by the sectors), and are supported by trust and the mutual exchange of goods and services. Other links will be weaker and less durable, depending on the common

objectives between the sectors of activity. However, all sectors must coincide in seeking sustainable development, so as to improve the quality of life in the associated locality. This knowledge about sustainable local development can also be tacit or explicit, taking into account the degree of formalization and the nature of the concepts involved [20]. Finally, this knowledge network is the product of the collective participation, territorial identity and social action of the subjects who address development problems [42].

In response to the described dynamics, interdisciplinary/transdisciplinary knowledge circulates and is socialized in extra-academic territorial or organizational scenarios [43]; additionally, it can be transferred through diffusion in social contexts of application, e.g., disciplinary, multidisciplinary, academic and interdisciplinary domains [38,44].

The agreement between social actors leads to the strengthening of governance in the locality where the relations among the sectors of activity are carried out. As relations between sectors increase, the stock of capacities and knowledge for sustainable local development, trust and solidarity are generated, citizen or community values are strengthened, and social capital also increases [7].

Thus, from the relationships among sectors of activity, interdisciplinary and trans disciplinary knowledge is produced which is based on cooperative integration in the exchange of goods and services (Figure 2), whose purpose is to generate a stock of skills in each as collective needs are met, and exchanges of goods and services take place in the governmental, social, university and production sectors, in the network of relationships that is formed in a locality [14,39]. In response to the dynamics described, interdisciplinary/transdisciplinary knowledge circulates and is socialized in localities, in organizations and in extra-academic settings [38,43,44].

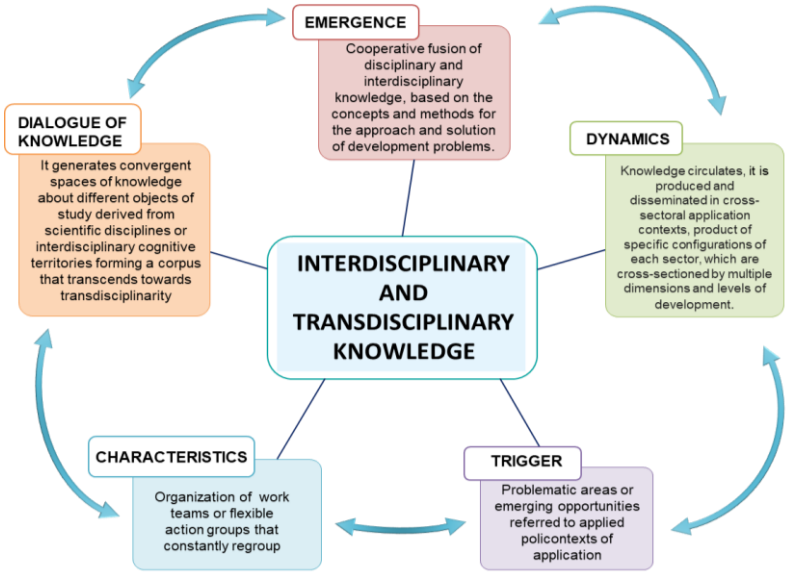

Figure 2. Own source. Inter and trans disciplinary knowledge. This figure presents the dynamics of the generation of inter- and trans- disciplinary knowledge.

To fulfill this purpose, the sectors must define mechanisms that allow joint agreement on the vision of the problem or object of study, the conceptual foundations, the approach methodologies, the use of the results, the follow-up and reflection on the way in which the relationships between the sectors and their products manifest themselves [45]. This dynamic is characterized by the exercise of the commonwealth, taking advantage of the potentialities/opportunities offered by the locality, as well as understanding of the historical-cultural nature of the population [46].

The configuration of an interdisciplinary or trans disciplinary body of knowledge, based on the relationships among the sectors of activity, implies the organization of teams of actors (research groups), belonging to the different sectors, which constitute local action

groups, made up of scientists, political managers, entrepreneurs and community social managers in general, who must have a flexible outlook in order to be able to depart from the purposes of their own discipline or their own particular objects of study, basic theories, methods and techniques of science if they are to address problems, theories and methods of other disciplines [14].

The previous analysis recognizes that academics, decision makers, the interested community and businesspeople transcend their own interests to pursue common objectives which promote sustainable local development, intersectorality and increase social capital, in order to improve the living conditions of the subjects of such development [7,38,43,47].

4.2. A Vision of Social Capital from the Perspective of Intersectorial Networks

The definition of social capital has multiple perspectives according to usage; in this sense, it can be assumed to infer the density of the social fabric in a locality [30]. It can also be understood as a nexus, bond or bridge which connects subjects with common objectives. Thus, social capital can also be defined as norms and networks. This work proposes the integration of the concept of social capital into the concept of the knowledge network for sustainable local development, recognizing that this is not a recent concept. However, despite the long existence of this concept, consensus does not exist regarding its definition; rather, it is generally known that it acquires three distinct meanings, as discussed earlier [27,47,48].

This situation has not prevented it from being considered a key concept in development studies, intersectorality and organizational networks, so that, despite theoretical difficulties, it is applied in the social capital sense, i.e., in the establishment of links and relations in the territories [29]. The relationships among sectors and people in particular are decisive for achieving substantial improvements in the quality of life and increasing competitiveness (Figure 3); this explains the interest that it arouses for the different sectors involved in development [7,27].

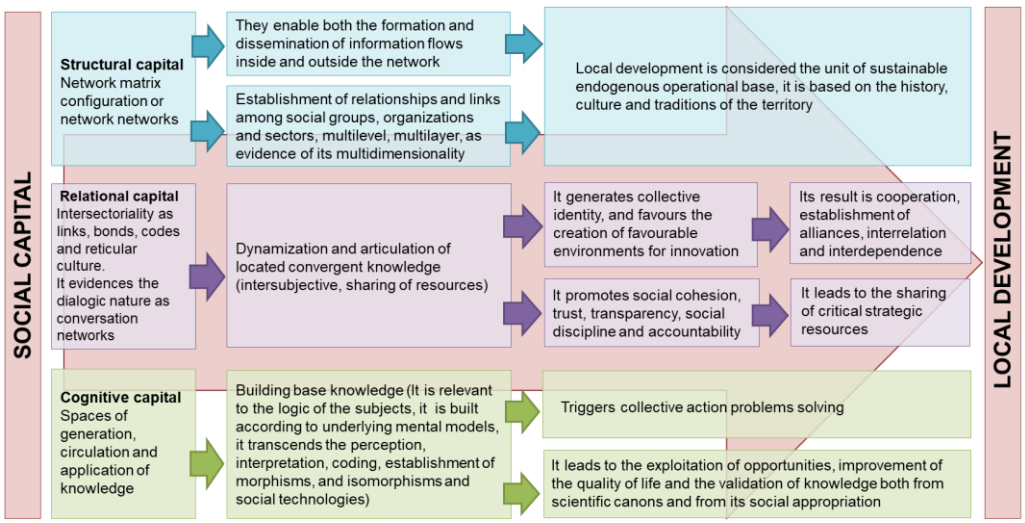

Figure 3. Own Source. Social capital and local development. The figure presents the most important definitions of social capital and its relationship with sustainable local development.

At present, there are numerous definitions of social capital that offer a conceptual structure of support, within which the concept coined by [30] was selected, given its relational approach, in which it is affirmed that social capital consists of "Traits of social organizations such as networks, norms and trust, that facilitate action and cooperation of mutual benefit". Social capital is a concept associated with intersectoral relationships and the construction of networks of knowledge that arises from planning management and intersectoral processes. Figure 3 shows the typologies of social capital associated with local development.

There are many definitions of social capital. In this research, Putnam's perspective will be used, as it is considered the most appropriate, taking into account the fact that it includes the typology of social capital as a network and, at the same time, refers to cognitive capital. This author also refers to social capital from a social organizational perspective, that incorporates trust, norms and networks as keywords. From these assessments, it is expected that social organizations improve their efficiency to the extent that they are capable of carrying out coordinated actions with other organizations and with society; therefore, it is expected that as a product of this joint work, social capital will be consolidated and increased [30].

A definition of social capital [49] the present researchers affirm is: "the sum of current and potential resources embedded within, made available by, and derived from the network of relationships owned by an individual or social unit. Social capital therefore includes both the network and the assets that could be mobilized through this network". For this reason, the social capital of an agent specifically requires: (1) a structural analysis aimed at identifying and quantifying the configuration of its network, and (2) a relational analysis that determines the nature of the relationships that it can maintain with other agents [50].

Based on this definition, social capital, is in turn, made up of a set of capitals, or resources from natural, financial or infrastructure sources, as linkages and values [47,48] which can be classified into three classes, as shown below.

Structural capital offers all the scaffolding, organization, levels and domains that constitute the flow of information within a social network [4]. Structural capital is said to recreate the matrix allowing the diffusion of content to the interior/exterior of the network [33]. This structure is sustained and constructed from units or blocks such as the production, university, government and social sectors, representing nodes of an intersectorial network in themselves with respect to others, and collectively representing a multilevel superstructure which is characteristic of local development [1,2,51]. According to [52], strong connections within organizations provide relationships of trust, while weak interorganizational connections give rise to new opportunities, thereby increasing diversity and development capabilities [29,53]. An extensive network can also act as a link, in particular for those who are out of any other activity.

The second type of social capital is known as relational capital; it is characterized by the exchange that occurs between the nodes or sectors. The strong or weak links through which different types of information flow make the reticular nature of Intersectorality evident. This social capital refers to social cohesion within communities or socially connected groups [27]. Relational capital includes the revitalization and articulation of intersubjective convergent knowledge, implies the sharing of resources, promotes identity and collective self-esteem and creates favorable environments for innovation based on cooperation relationships, alliances, interrelation and interdependence [53]. All this plays a strategic role in the sharing of critical resources within the network [48,54]. Relational capital has to do with the interactions within a territory; it is a union-bridge form of capital that unites society as a whole, with the idea of promoting strong, close and lasting synergistic relationships in its interior that, in turn, give rise to external relationships or the establishment of bonds of connection, which share codes and visions of the world from an interrelated systemic perspective [52].

Finally, cognitive capital describes zones of the generation, circulation and application of knowledge that forms the basis of the generation of social technologies, systems and schemes of action or plans that find empirical territories of use [48], whose origin is scientific, extrascientific or a complementarity or integration of both. This knowledge follows the logic of the mental models that prefigure the subjects, and makes their validation in social organizational or community collective contexts feasible [55].

5. Results and Discussion

Theories of networks, development, Intersectorality and the construction of inter- and trans- disciplinary knowledge supported, in an interrelated way, the graphic representation

of the intersectorial knowledge network for local development which is presented in this section [44].

5.1. Design of a Knowledge Network for Sustainable Local Development

Abstract design represents the components and processes that are carried out in the knowledge network, both schematically and discursively. A characterization of the behavior of the actors for sustainable local development, and representation of the action system that these subjects deploy in the operational processes of development [27,29,30,48], were also incorporated. Based on these procedures and using the abductive method [35], it was possible to configure, based on the deductive inference technique, ideas that favor the design of the knowledge network for sustainable local development [56].

The discussion begins by emphasizing the links that occur from the exchange of resources in a network. From this perspective, it is necessary to establish links as a condition which addresses relationships in the context of development [27]. Within this relational framework, it is possible to explain the underlying motivation for the constitution of a knowledge network for sustainable local development, which helps us to understand the establishment of strong or weak ties [56], both from a cross-sectorial horizontal perspective and with regard to sectoriality and interorganizational relations. Such links maintain cohesion among organizations of the same nature.

Also within the sectors, strong relationships are established (Figure 4) which are sustainable over time and which contribute to the strengthening of the redial culture and the generation of knowledge, in both the sectorial and organizational contexts [7]. Moreover, any process of construction of knowledge is dependent upon the individual, i.e., is based upon his/her cognitive load, mental models, ideologies, vision of the world, values, culture and history, and is constantly influenced while itself influencing the network relationships that it sustains in the immediate environment in which it was generated [57,58].

The characteristics of the strong and weak relationships in intersector knowledge networks can be observed in Figure 4. Here, they are represented according to the thickness of the lines; a thick line implies a strong and lasting relationship, while thin lines indicate less durable relationships; the dotted arrows indicate weak relationships, implying a predilection for adaptation and transformations which allow evolution to occur within the network and make connections with other nodes possible [27].

In light of this derivation, it is clear that the ties in the matrix, when they are not permanent, or are not the product of strong relationships, stimulate redial heterophily. In contrast, this happens with solid arrows, which refer to strong relationships, cohesive and lasting bonds that increase the degree of redial homophily [29]. Another important aspect is the sense of the link, this represents the interdependence or dependence, as well as the relative autonomy of the interactions in the reticular context [48].

Knowledge within the network is produced as a result of the processes of the relationship and integration between sectors based on common objectives, for local development that involves scientists, society, political managers and the production sector, which, through collective action, configure interdisciplinary and trans disciplinary knowledge [14,26,42,59].

The complementary or integration approach, between tacit and explicit knowledge, contributes to the conformation of morphisms and isomorphisms, as an effort of the different actors of the various sectors to integrate both the theories and the frameworks of action that have their raison d'être in epistemologies and ontologies which favor transdisciplinarity [39].

According to [27], the bonds of union (strong connections within the groups) provide relationships of trust that give rise to new opportunities and increase diversity and the capacity for knowledge recovery [29,53]. In line with these proposals, it is noted that the network of relationships to be able to configure or increase social capital, must be based on trust, cooperation, commitment and reciprocity, as well as accepted norms and values [27].

Social capital as a concept that promotes Intersectorality and the construction of network knowledge is a product of the planning and management of local development [32], and incorporates the three fundamental dimensions reflected in the previous chart. The first deals with the structural capital that recreates the network and enables the interchange of content inside and outside of that network. This structure includes the following components: production, academia, governmental and social sectors, which constitute the modes that are related inside themselves from the point of view of the organizations that integrate each one and between each sector, forming a dense structure of relationships which is a characteristic of local development [27].

The second dimension, relational capital, characterizes the exchange between nodes or sectors; these have fostering links, i.e., strong or weak ties [32], through which different types of information flow, which is a characteristic of intersectorality [7]. The network has norms and values as elements of the culture of sectoral relationships (Figure 4).

All this knowledge transfer is possible thanks to social cohesion within the network, participation and adherence to common values and principles that underpin cooperation agreements and alliances among sectors [30]. Cognitive capital, the third dimension, describes the knowledge generated in the planning and management of sustainable local development processes, so that the production, circulation and application of relevant knowledge leads to continuous improvements in local development practices and processes, thereby strengthening social capital. This requires collective action between the sectors to solve common problems by taking advantage of the opportunities of the context and the emerging knowledge of the territories [14,15,22,60,61].

This integration favors processes of governance of common goods in the network, and is associated with the capacity for collective action, so the norms and values that encourage this collective action may also be defined as social capital [48]. That link, which has not yet been fully explained, represents the intersectoral relationships among the production, government, community and university sectors (Figure 4).

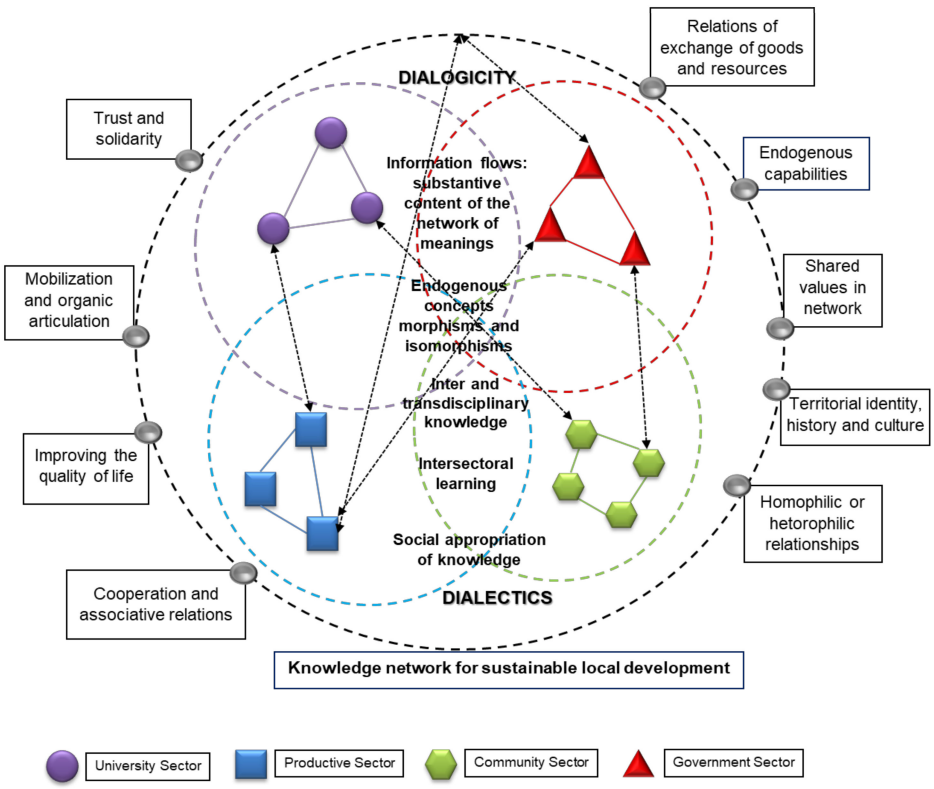

Figure 4. Own Source. Knowledge network for sustainability. The figure comprises knowledge of local development processes that are leveraged by the relationships of the activity sectors.

The network, from an operational point of view, is considered to be a complex product in which the reciprocal exchange of strategic resources takes place, given their degrees of importance for the operation of each sector [14]. The links and the information they contain represent social resources that favor integration, as well as social capital and development processes. Information about the crucial aspects of development must be available and be used to address the problems and needs of the localities [62].

5.2. The Network Components

Network Components refers to the empirical or material conditions of the network in terms of its properties and formal resources, understood as any component that adds value, including those pertaining to knowledge about local development, those generated through the implementation of policies or those related to the agency of resources of diverse nature, e.g., scientific, technical or political. The availability of resources establishes inequalities of power and influence in the network, so this is an important aspect to consider in order to maintain social equity and equity in participation [42].

Regarding the arrangement of the components of the network, the society node provides a workforce, money (self-management and comanagement), its social organization and leadership. The government node contributes as a public sector, providing an institutional-regulatory framework (normative laws, responsible public services), as well as partial financing (funds for projects, programs and special initiatives). In the same way, it shares resources for the large-scale implementation of programs, grants and the construction of infrastructure [27].

Likewise, the node of the private production sector exchanges goods and services, behaves according to the logic of the market, exercises social responsibility, and contributes to social employment, the generation of wealth, entrepreneurship and investment [46]. The node of the university sector provides specialized workers (scientists, consultants and inventors), designs methodologies and processes, and validates information, infrastructure for the deployment of R + D + I processes, such as, validated knowledge in the form of scientific publications, experience, laboratories, research centers, institutes, national and international contacts, patents and consultancies [45].

In general terms, the requirements of the nodes, taking into account both their constitution and their own purposes, establish the disposition within the network, in turn implying the type of influence or power that they have or can exercise over the other nodes [29]. The organization of these nodes is summarized in Figure 4.

From this perspective, it is possible to affirm that when the nodes share the same information or resource flows and have the same components within their sectors, they can form specialized structures, with common characteristics and strong relationships, called clusters or hubs, depending on their composition [27].

The relevance or location of the nodes in the network is associated with the interactions and distance among them, as well as the position occupied; hence, interlaced links favor types of associations or relationships and define the content of the flows, principles and constructed values within the sectors, [57] considering that the links have a purpose for their constitution which determines the power relationship.

5.3. Network Operability

This section refers to the how, why, who and for what reason specific actors are involved in knowledge networks for local development. As such, it is necessary to take into account both the density or quantity of ties or bonds and their cohesion or nature, and their representation in terms of the degree of relationship or entanglement (ties) in the matrix [54]. In accordance with previous ideas, these are sectors that are managed by people; they contribute a historical cultural load to the network that determines the ways of relating to each other in the institutional settings, as well as within the sector. Therefore, it is possible to affirm that the operation of the network is the product of the actions, interactions and transactions carried out by individuals in these sectors [55].

Considering previous approaches, it can be said that the set of relationships (such as association, cooperation, mutual help, philanthropy, reciprocal altruism, cooperation, collaboration, interdependence and connection) and the nature of the network, i.e., its, epistemological, ontological and methodological properties, characterize the network and guide its purpose [7].

In this sense, the proximity and distance between nodes and sectors make it possible to establish the position (participation) of each sector in local development processes [7,33]. The operations themselves refer to the links and connectivity between the nodes, as well as the intensity in the framework of the relationship, at the same time determining the frequency in which these relationships arise, while the directionality, both direct and transitive, refers to the orientation of information flows, favors the interchange of information and mobilizes resources, as well as their articulation, and enhances the constructive processes of inter- and trans- disciplinary knowledge [51].

The processes of participation among sectors, accountability or social auditing and power games are part of the processes of governance of intersectoral networks, in terms of decision making, to address needs and development problems [63]. Therefore, efficiency and social efficiency depend, as a fundamental premise, upon decision-making based on the availability of information flow [7]. The governance of the network confers legitimacy on the performance of the leading sectors in the network during the articulation and coordination of the material and symbolic efforts within the matrix, since the network gives its own dialogical space of participation for the making of decisions from a dialectical position, in the midst of conflicts and tensions coming from the horizontal government network, where hierarchies are reduced to the logic of the surrounding environment.

6. Conclusions

Based on the presented findings, it is possible to infer that knowledge networks for local development facilitate intersectorality by offering a support structure for its processes. Through the establishment of relationships among various sectors, such networks promote the improvement of the quality of life of the local population.

This improvement in quality of life is associated with the resolution of collective, environmental, economic and social problems. These approaches are associated with the application of policies in each of these areas. As a result of this, knowledge is generated (referred to as the "stock of capacities of the population" in this research), and new practices and ideas emerge to address the problems of the locality that impact people's lives.

The knowledge network for local development does not have a pre-established or rigid form, but is made up of components that determine its structure and that, at the same time, carry out operations and processes to fulfill tasks.

Changes in formal properties (density, centrality and intermediation) influence the opportunities that network members have to find suitable allies; therefore, trust is a key aspect, both for increasing social capital and for the sustainability of relations between sectors.

Thus, networks change as the environment changes, that is, they self-regulate, which allows them to adapt and transform their priorities and goals, maintaining links, establishing relationships among sectors and strengthening strategic alliances to produce new communication links that broaden the horizons of the network. Cohesion at the core of the network reinforces cooperation, while adding or gaining nodes, diversifying relationships and strengthening heterophily.

In this way, further links result from the establishment of links between sectors that promote cultural change within the intersectoral space, increasing the competencies of sectors to work with nodes of different kinds, in the midst of tensions and conflicts, necessarily involving the sectors in horizontal negotiation and dialogue.

In this sense, it is essential for network management to consider the proximity in which the production, social, university and government sectors operate, as well as the mediation that is determined by access and control of information-knowledge flows; interdependence

in exchanges and disputes over resources which are considered strategic. Intersectoral relationships within the network have positive implications for local development, since having a high degree of interdependence and density can generate favorable environments.

However, the formation of sectors is not enough; it is necessary that the sectors interrelate in an interdependent manner and that formal cooperation and competition relationships emerge among them.

Consequently, it is affirmed that the knowledge network for local development is determined by the knowledge accumulated and shared internally and externally by the organizations that make up the involved sectors, which are related through the information flows that they share in the network, in such a way that the interaction between these parties is associated with its components, operations, culture and the environment in which it is found.

In light of this, the creation of intersectoral knowledge networks favors sustainable local development, while also benefiting the deployment of capacities in a territory. Reducing uncertainty and promoting the social capital of the locality, it contributes to decision-making in the various sectors of activity, while also strengthening relationships. Finally, it is proposed that reciprocity relationships among sectors in a network are a desirable characteristic for the implementation of specific policies for local development.

Author Contributions: This article is the result of a team investigation, in such a way that the research, conceptualization, writing and layout was carried out by A.S.-N., the methodology, review for adjustments, final editing and application management was developed by F.M.-G., the adjustment to the journal's standards, revision and translation was carried out by M.N.C., final revision and financing management was responsibility of A.I.G., the revision and adjustment of the final version was developed by A.J.P.C. as well as the tasks supervision. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable for studies not involving humans or animals.

Informed Consent Statement: Not applicable for studies not involving humans.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Tovey, H. Sustainability: A Platform for Debate. *Sustainability* **2009**, *1*, 14–18. [CrossRef]
2. Wilbanks, J.; Wilbanks, T.J. Science, Open Communication and Sustainable Development. *Sustainability* **2010**, *2*, 993–1015. [CrossRef]
3. Cummings, S.; Seferiadis, A.A.; Maas, J.; Bunders, J.F.; Zweekhorst, M.B. Knowledge, Social Capital, and Grassroots Development: Insights from Rural Bangladesh. *J. Dev. Stud.* **2018**, *55*, 161–176. [CrossRef]
4. Pesch, U.; Spekkink, W.; Quist, J. Local sustainability initiatives: Innovation and civic engagement in societal experiments. *Eur. Plan. Stud.* **2019**, *27*, 300–317. [CrossRef]
5. Mauser, W.; Klepper, G.; Rice, M.; Schmalzbauer, B.S.; Hackmann, H.; Leemans, R.; Moore, H. Transdisciplinary global change research: The co-creation of knowledge for sustainability. *Curr. Opin. Environ. Sustain.* **2013**, *5*, 420–431. [CrossRef]
6. Giedrė, A.; Baranauskaitė, L. Investigating Complexity of Intersectoral. Collaboration: Contextual Framework for Research. In *Contemporary Research on Organization Management and Administration*; Academic Association of Management and Administration: Riga, Latvia, 2018; Volume 6. Available online: http://journal.avada.lt/images/dokumentai/2018/CROMA_2018_6_1_79-89.pdf (accessed on 4 November 2020).
7. Berkes, F.; Seixas, C.; Fernandes, D.; Medeiros, D.; Maurice, S.; Shukla, S. *Lessons from Community Self-Organization and Cross-Scale Linkages in Four Equator Initiative Projects*; Natural Resources Institute, University of Manitoba: Winnipeg, MB, Canada, 2007; pp. 1–30. Available online: https://idl-bnc-idrc.dspacedirect.org/bitstream/handle/10625/31457/123949.pdf (accessed on 4 November 2020).
8. Montalbán-Domingo, L.; Aguilar-Morocho, M.; García-Segura, T.; Pellicer, E. Study of Social and Environmental Needs for the Selection of Sustainable Criteria in the Procurement of Public Works. *Sustainability* **2020**, *12*, 7756. [CrossRef]
9. Jerneck, A.; Olsson, L.; Ness, B.; Anderberg, S.; Baier, M.; Clark, E.; Hickler, T.; Hornborg, A.; Kronsell, A.; Lövbrand, E.; et al. Structuring sustainability science. *Sustain. Sci.* **2010**, *6*, 69–82. [CrossRef]

10. Maher, R.; Maher, M.; Mann, S.; McAlpine, C.A. Integrating design thinking with sustainability science: A Researchv through Design approach. *Sustain. Sci.* **2018**, *13*, 1565–1587. [CrossRef]
11. Mukhopadhyay, P.; Nepal, M.; Shyamsundar, P. Building skills for sustainability: A role for regional research networks. *Ecol. Soc.* **2014**, *19*, 45. [CrossRef]
12. Cunill-Grau, N. La intersectorialidad en las nuevas políticas sociales. Un acercamiento análitico-conceptual. *Gest. Polit. Pública.* **2014**, *23*, 5–46.
13. Wuelser, G.; Pohl, C. How researchers frame scientific contributions to sustainable development: A typology based on grounded theory. *Sustain. Sci.* **2016**, *11*, 789–800. [CrossRef] [PubMed]
14. Weichselgartner, J.; Kasperson, R. Barriers in the science-policy-practice interface: Toward a knowledge-action-system in global environmental change research. *Glob. Environ. Chang.* **2010**, *20*, 266–277. [CrossRef]
15. Muñoz-Erickson, T. How Cities Think: Knowledge-Action Systems Analysis for Urban Sustainability in San Juan, Puerto Rico. Ph.D. Thesis, Arizona State University, Tempe, AZ, USA, 2012. Available online: https://repository.asu.edu/attachments/94135/content//tmp/package-zUBFpT/MunozErickson_asu_0010E_11592.pdf (accessed on 4 November 2020).
16. Ayala-Orozco, B.; Rosell, J.A.; Merçon, J.; Bueno, I.; Alatorre-Frenk, G.; Langle-Flores, A.; Lobato, A. Challenges and Strategies in Place-Based Multi-Stakeholder Collaboration for Sustainability: Learning from Experiences in the Global South. *Sustainability* **2018**, *10*, 3217. [CrossRef]
17. Shi, Q.; Deng, X.; Shi, C.; Chen, S. Exploration of the Intersectoral Relations Based on Input-Output Tables in the Inland River Basin of China. *Sustainability* **2015**, *7*, 4323–4340. [CrossRef]
18. Ziuzya, E.V.; Voronkova, O.Y.; Umirzakova, D.K.; Rakovskiy, V.I.; Qurbanov, P.A.; Kazakov, A.V. A Methodological Approach to Assessing the Efficiency of the Economic Mechanism for Formation and Development of Intersectoral Linkages. *Int. J. Civ. Eng.* **2019**, *10*, 920–925.
19. Scheunemann-De Souza, I.S. Política y Gestión de las Redes. In *Redes de Conocimiento Construcción, Dinámica y Gestión*, 1st ed.; Albornoz, M., Alfaraz, C., Eds.; Red Iberoamericana de Indicadores de Ciencia y Tecnología (RICYT) del Programa Iberoamericano de Ciencia y Tecnología para el Desarrollo (CYTED) y la Oficina Regional de Ciencia para América Latina y el Caribe de la UNESCO: Buenos Aires, Argentina, 2006; pp. 215–218. Available online: http://repositorio.minciencias.gov.co:8080/bitstream/handle/11146/468/1669-ALBORNOZ_2006_REDES_DE_CONO.PDF?sequence=1&isAllowed=y (accessed on 4 November 2020).
20. Kaiser, D.B.; Weith, T.; Gaasch, N. Co-Production of Knowledge: A Conceptual Approach for Integrative Knowledge Management in Planning. *Trans. Assoc. Eur. Sch. Plan.* **2017**, *1*, 18–32. [CrossRef]
21. Pohl, C.; Rist, S.; Zimmermann, A.; Fry, P.; Gurung, G.S.; Schneider, F.; Speranza, C.I.; Kiteme, B.; Boillat, S.; Serrano, E.; et al. Researchers' roles in knowledge co-production: Experience from sustainability research in Kenya, Switzerland, Bolivia and Nepal. *Sci. Public Policy* **2010**, *37*, 267–281. [CrossRef]
22. McNie, E.C. Reconciling the supply of scientific information with user demands: An analysis of the problem and review of the literature. *Environ. Sci. Policy* **2007**, *10*, 17–38. [CrossRef]
23. Ruiz-Real, J.L.; Uribe-Toril, J.; Valenciano, J.D.P.; Manso, J.P. Ibero-American Research on Local Development. An Analysis of Its Evolution and New Trends. *Resources* **2019**, *8*, 124. [CrossRef]
24. Becker, E. Social-Ecological Systems as Epistemic Objects. In *Human-Nature Interactions in the Anthropocene: Potentials of Social Ecological Systems Analysis*; Marion, G.G.K., Beate, R.M., Eds.; Welp Routledge: London, UK, 2011; pp. 37–59. Available online: https://www.researchgate.net/publication/256259334_Social-Ecological_Systems_as_Epistemic_Objects (accessed on 4 November 2020).
25. Díaz, A.L.; Chan, A.; Harley, K.; Matus, S.; Suerie Moon, W.C.; Murthy, C.W. Making Technological Innovation Work for Sustainable Development. Harvard Kennedy School University Faculty Research Working Paper Series; London, UK, 2015; pp. 15–79. Available online: https://research.hks.harvard.edu/publications/getFile.aspx?Id=1294 (accessed on 4 November 2020).
26. Lang, D.; Wiek, A.; Bergmann, M.; Stauffacher, M.; Martens, P.; Moll, P.; Swilling, M.; Thomas, C.J. Transdisciplinary research in sustainability science: Practice, principles, and challenges. *Sustain. Sci.* **2012**, *7*, 25–43. [CrossRef]
27. Safak, B. The Relation between Social Capital and Trust with Social Network Analysis World Academy of Science, Engineering and Technology. *IJCTE* **2016**, *10*, 28. [CrossRef]
28. Holmes, L.; LaHurd, A.; Wasson, E.; McClarin, L.; Dabney, K.W. Racial and Ethnic Heterogeneity in the Association Between Total Cholesterol and Pediatric Obesity. *Int. J. Environ. Res. Public Health* **2015**, *13*, 19. [CrossRef] [PubMed]
29. Newman, L.; Dale, A. Homophily and Agency: Creating Effective Sustainable Development Networks. *Environ. Dev. Sustain.* **2007**, *9*, 79–90. [CrossRef]
30. Putnam, H. Realism without absolutes. *Int. J. Philos. Stud.* **1993**, *1*, 179–192. [CrossRef]
31. Yu-Bing, W.; Ching-Wei, H. No Money? No Problem! The Value of Sustainability: Social Capital Drives the Relationship among Customer Identification and Citizenship Behavior in Sharing Economy. *Sustainability* **2017**, *9*, 1400. [CrossRef]
32. Juhola, S.; Westerhoff, L. Challenges of adaptation to climate change across multiple scales: A case study of network governance in two European countries. *Environ. Sci. Policy* **2011**, *14*, 239–247. [CrossRef]
33. Kim, H.; Yang, S. Neighborhood Walking and Social Capital: The Correlation between Walking Experience and Individual Perception of Social Capital. *Sustainability* **2017**, *9*, 680. [CrossRef]

34. Abdol Aziz, S. Sustainable regional development through knowledge networks: Review of case studies. *Front. Archit. Res.* **2019**, *8*, 471–482.
35. Staat, W. On abduction, deduction, induction and categories. *Trans. Charles S Peirce Soc.* **1993**, *29*, 225–237.
36. Abbott, A. Basic debates and methodological practices. *Methods of Discovery: Heuristics for the Social Sciences*. Chapter 2. 2004, pp. 19–39. Available online: https://www.humanscience.org/docs/Abbott%20(2004)%20Methods%20of%20Discovery%202.pdf (accessed on 4 November 2020).
37. Mirza, N. Effects of abductive reasoning training on hypothesis generation abilities of first and second year baccalaureate nursing students. A Thesis Submitted to the School of Graduate Studies in Partial Fulfilment of the Requirements for the Degree Doctor of Philosophy, McMaster University. Copyright by Noeman Ahmad Mirza. 2015. Available online: https://macsphere.mcmaster.ca/bitstream/11375/18113/2/Noeman%20Mirza%20FINAL%20Thesis%20D29M06Y2015.pdf (accessed on 4 November 2020).
38. Burawoy, M. The Extended Case Method Four Countries, Four Decades, Four Great Transformations, and One Theoretical Tradition. 2008, pp. 192–219. Available online: https://www.researchgate.net/publication/285934790_The_extended_case_method_Four_countries_four_decades_four_great_transformations_and_one_theoretical_tradition (accessed on 4 November 2020).
39. Quaranta, G.; Citro, E.; Salvia, R. Economic and Social Sustainable Synergies to Promote Innovations in Rural Tourism and Local Development. *Sustainability* **2016**, *8*, 668. [CrossRef]
40. Mensah, J. Sustainable development: Meaning, history, principles, pillars, and implications for human action: Literature review. *Cogent Soc. Sci.* **2019**, *5*, 1653531. [CrossRef]
41. Antonescu, D. *Theoretical Approaches of Endogenous Regional Development*; Institute of National Economy: Bucharest, Romania, 2015; MPRA is a RePEc Service Hosted by the Munich University Library in Germany. Available online: https://mpra.ub.uni-muenchen.de/64679/ (accessed on 4 November 2020).
42. Meisert, A.; Böttcher, F. Towards a Discourse-Based Understanding of Sustainability Education and Decision Making. *Sustainability* **2019**, *11*, 5902. [CrossRef]
43. Thorén, H. The Hammer and the Nail: Interdisciplinary and Problem Solving in Sustainability Science. Ph.D. Thesis, Lund University, Lund, Sweden, 2015. Available online: https://portal.research.lu.se/ws/files/6044493/5048299.pdf (accessed on 4 November 2020).
44. Walker, B.H.; Carpenter, S.R.; Anderies, J.M.; Abel, N.; Cumming, G.S.; Janssen, M.A.; Lebel, L.; Norberg, J.; Peterson, G.; Pritchard, R. Resilience Management in Social-ecological Systems: A Working Hypothesis for a Participatory Approach. *Conserv. Ecol.* **2002**, *6*, 1–14. [CrossRef]
45. Fritz, L.; Binder, C. Participation as Relational Space: A Critical Approach to Analysing Participation in Sustainability Research. *Sustainability* **2018**, *10*, 2853. [CrossRef]
46. Ziervogel, G.; Archer, E.; Price, P. Strengthening the knowledge–policy interface through co-production of a climate adaptation plan: Leveraging opportunities in Bergrivier Municipality, South Africa. *Environ. Urban.* **2016**, *28*, 455–474. [CrossRef]
47. Thorén, H.; Persson, J. The Philosophy of Interdisciplinarity: Sustainability Science and Problem-Feeding. *J. Gen. Philos. Sci.* **2013**, *44*, 337–355. [CrossRef]
48. Righi, A. Measuring Social Capital: Official Statistics Initiatives in Italy. *Procedia Soc. Behav. Sci.* **2013**, *72*, 4–22. [CrossRef]
49. Nahapiet, J.; Ghoshal, S. Social Capital, Intellectual Capital and the Organizational Advantage. *Acad. Manage. Rev.* **1998**, *23*, 242–266. [CrossRef]
50. Blasco-Bocigas, P.; Navas-López, E.; López-Sáez, P. El efecto mediador del capital social sobre los beneficios de la empresa: Una aproximación teórica. *Cuad. Estud. Empresariales* **2010**, *20*, 11–34.
51. Brink, E.; Wamsler, C.; Adolfsson, M.; Axelsson, M.; Beery, T.; Björn, H.; Bramryd, T.; Ekelund, N.; Jephson, T.; Narvelo, W.; et al. On the road to 'research municipalities': Analysing transdisciplinarity in municipal ecosystem services and adaptation planning. *Sustain. Sci.* **2018**, *13*, 765–784. [CrossRef]
52. Ortiz, B.; Donate, M.J.; Guadamillas, F. Relational and Cognitive Social Capital: Their Influence on Strategies of External Knowledge Acquisition. *Procedia Comput. Sci.* **2016**, *99*, 91–100. [CrossRef]
53. Borgatti, S.P.; Foster, P.C. The Network Paradigm in Organizational Research: A Review and Typology. *J. Manag.* **2003**, *29*, 991–1013.
54. Garcia-Diez, S.G. Measurement of Social Capital with the Help of Time Use Surveys. *Procedia Soc. Behav. Sci.* **2013**, *72*, 23–31. [CrossRef]
55. Carrillo-Álvarez, E.; Riera-Roman, J. Measuring social capital: Further insights. *Gaceta Sanitari* **2017**, *31*, 57–61. Available online: http://scielo.isciii.es/pdf/gs/v31n1/0213-9111-gs-31-01-00057.pdf (accessed on 4 November 2020).
56. Chen, C.J.; Huang, J. How organizational climate and structure affect knowledge management—The social interaction perspective. *Int. J. Inf. Manag.* **2007**, *27*, 104–118. [CrossRef]
57. Zou, T.; Su, Y.; Wang, Y. Examining Relationships between Social Capital, Emotion Experience and Life Satisfaction for Sustainable Community. *Sustainability* **2018**, *10*, 2651. [CrossRef]
58. Parsons, M.; Nalau, J.; Fisher, K. Perspectivas alternativas sobre la sostenibilidad: Conocimiento y metodologías indígenas. *Chall. Sustain.* **2017**, *5*, 3–14. [CrossRef]

59. Hessels, L.K.; Van Lente, H. Re-thinking new knowledge production: A literature review and a research agenda. *Res. Policy* **2008**, *37*, 740–760. [CrossRef]
60. Weichselgartner, J.; Kelman, I. Geographies of resilience. *Prog. Hum. Geogr.* **2015**, *39*, 249–267. [CrossRef]
61. Evans, M.C.; Cvitanovic, C. An introduction to achieving policy impact for early career researchers. *Palgrave Commun.* **2018**, *4*, 88. [CrossRef]
62. Armitage, D.R.; De Loë, R.; Plummer, R. Environmental governance and its implications for conservation practice. *Conserv. Lett.* **2012**, *5*, 245–255. [CrossRef]
63. Opdam, P.; Luque, S.; Nassauer, J.; Verburg, P.; Wu, J. How can landscape ecology contribute to sustainability science? *Landsc. Ecol.* **2018**, *33*, 1–7. [CrossRef]